

(19)

## KOREAN INTELLECTUAL PROPERTY OFFICE

## KOREAN PATENT ABSTRACTS

(11) Publication number:

**1020030086157****A**(43) Date of publication of application:  
**07.11.2003**

(21) Application number:

**1020020024539**

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(22) Date of filing:

**03.05.2002**

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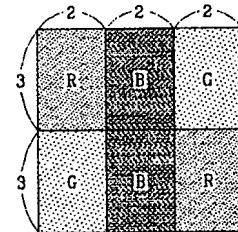
(51) Int. Cl

**G02F 1/133**

(54) LCD

(57) Abstract:

**PURPOSE:** A liquid crystal display device is provided to form each pixel area in the symmetrical square shape for precise image display, thereby realizing the high resolution in the display of characters or figures. **CONSTITUTION:** A liquid crystal display device includes pixels arranged in the PenTile matrix structure. In the line direction, red, blue and green pixels(R,B,G) are arranged in sequence. In the column direction, the red and green pixels are arranged alternately and the blue pixels are arranged in the same column. In neighboring two lines, the red and green pixels respectively face each other via the blue pixels in the diagonal direction. The rate of traverse and longitudinal pixels is 1:1 in a symmetric square shape.



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## Legal Status

Date of request for an examination (20070503)

Notification date of refusal decision (00000000)

Final disposal of an application (application)

Date of final disposal of an application (00000000)

Patent registration number ( )

Date of registration (00000000)

Number of opposition against the grant of a patent ( )

Date of opposition against the grant of a patent (00000000)

Number of trial against decision to refuse ( )

Date of requesting trial against decision to refuse ( )



## Patent Application

Right Classification	Patent.
Receiver	Commissioner of KIPO.
Submission Date	2002.05.03
Korean Title of Invention	liquid crystal device
English Title of Invention	liquid crystal device
Applicant	SAMSUNG ELECTRONICS CO., LTD.
Name	1-1998-104271-3
Applicant Code	
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Individual id number	Secure Information
Postal code or zip code	Secure Information
Address	Secure Information
Nationality	KR
Purport	We file an application under Article 42 of Patent Act as above. Agent YOU ME PATENT & LAW FIRM (Signature)
Official Fee	
Application Fee	19 page(s) 29,000 won.
Additional Application Fee	0 page(s) 0 won.
Priority Fee	0 case 0 won.
Examination Fee	0 claim(s) 0 won.
Total	29,000 won.
Attached Documents	
1. 1 summary - specification(drawing).	

## Patent Specification

## Abstract

**Abstract** The present invention relates to the liquid crystal display.

In the liquid crystal display, the red, the green, and the blue pixel are successively arranged to the line writing direction. And in order to face four pixel of the green and red is arranged in the cephalization deed in which the red and green pixel are by turns arranged to the column direction and in which the blue pixel is identically arranged and which is adjacent around the blue pixel. As to each pixel, the rate of the arm length is made of 2:3. Therefore, in the neighboring cephalization deed, when it can be said to be one pixel region to be arranged so that four pixel of the green and the red which is adjacent around neighboring two blue pixels be in opposite directions, it is formed with the square in which one pixel region is a symmetric, the exact image expression is made.

According to this the present invention, when indicating the image of figure and letter, an image can be indicated by the more favorable high definition.

## Representative Drawing

Drawing 2

## Index Term

The phental structure, a pixel, and LCD.

## Specification

## Title of Invention

liquid crystal device{liquid crystal device}

## Brief Description of the Drawings

Figure 1 is an arrangement plan showing the pixel array structure of the liquid crystal display for having the pixel array of the pentile structure according to a preferred embodiment of the present invention.

Figure 2 is a drawing showing each pixel elements size at the pixel region of one illustrated in Figure 1.

Figure 3 is a drawing showing the pixel structure of the thin film transistor of the liquid crystal display according to a preferred embodiment of the present invention.



Figure 4 is a cross-sectional view of the thin film transistor substrate for liquid crystal display device which it cuts in fig. 2 according to the IV-IV' line, it shows.

Figure 5 is a drawing showing each pixel elements size at one pixel region according to another preferred embodiment of the present invention.

#### The Detailed Description of Invention

##### The Purpose of Invention

###### Field of Invention and the Prior Art

The present invention relates to the liquid crystal display, more particularly, to an apparatus and method for operating the liquid crystal display, for having the penile pixel array structure for indicating the image of the high definition and this.

As to the liquid crystal display, by injecting the liquid crystal material between the two-board having the electrode producing the electric field and authorizing the different electric potential in two electrodes it forms the electric field and generally it changes the arrangement of the liquid crystal molecules. It is the apparatus for expressing an image through this, by controlling the transmittance ratio of the light.

This liquid crystal display has a plurality of pixels in which the pixel electrode and red, the green, and the color filter of the blue are formed. And each pixels run with the signal applied through the wiring and the indication action is made. In the wiring, it has the image signal line or data line delivering the scanning signal line or the gate line delivering the scanning signal, and the picture signal. And the picture signal which is delivered to the pixel electrode through this, formed in a pixel while as to each pixel, the thin film transistor connected to one gate line and one data line is formed is controlled.

At this time, there can be the mosaic type, who successively arranges the red (R), the green (G), and the color filter of the blue (B) to the stripe type arranging the pixel row the color filter of the colour binding to the unit, and the heat and line writing direction the delta type etc, arranges and successively arranges the red (R), the green (G), and the color filter of the blue (B) to the zig-zag type in order to be unit pixels crossed in the column direction as the array method the red (R), the green (G), and the color filters of the blue (B) are variously arranged in each pixel. In case of a delta-like, when indicating an image three unit pixels including the red (R), the green (G), and the color filter of the blue (B) by one dot, a circular or a diagonal is expressed in the display and it has the favorable expressive power.

Moreover, in "ClairVoyante Laboratories", the pixel array structure called "The PenTile Matrix™ color pixel arrangement" which had the expressive power of the more favorable high definition when indicating an image and could minimize the design cost at the same time was suggested. In the pixel array structure of this penile matrix, the unit pixel of the blue is together shared when indicating two dots. And data signal is delivered by one data drive integrated circuit and the unit pixel of the neighboring blue runs with the different gate drive integrated circuit. The number of cheap gate drive integrated circuit this penile matrix pixel structure is useds can reduce the number of overhead data drive integrated circuit it increaseses and it can minlize the design cost of the display device.

But generally, the arm vertical ratio of one pixel is 1:3. The liquid crystal display for having the pixel array of the penile matrix indicates the blue pixel, formed through two rows the red and the green pixel which is arranged in order to face around this by one dot. Therefore one dot is shaped of the asymmetrical rectangular.

Therefore, one dot does not fit for the VESA (Video Electronics Standards Association) standard. And the problem that the exact image expression is not facilitated is generated according to that.

###### Technical Problems to be solved by the Invention

Therefore, the technical problem of the present invention provides the liquid crystal display for doing the exact at the same time image display in which the display ability is excellent

#### The Structure and Function of the Invention(Device)

In the liquid crystal display according to the characteristic of the present invention for achieving this technical problem, the red, the blue, and the green pixel are successively arranged to the line writing direction. And the red and green pixel are by turns arranged to the column direction and the blue pixel is identically arranged. The pixel array which is arranged in order to four pixel of the green and the red which is adjacent around two blue pixels which are adjacent in the neighboring cephalization deed be in opposite directions is formed. Here, it is made of the red, and in each pixel of the green and blue, the rate of the arm length 2:3.

Here, it is arranged as the cross direction about the pixel row. And the gate line delivering the scanning signal or the gate signal is formed in a pixel. And it intersects with the gate line and insulation and the gate line is arranged as a lengthwise. And the respective arranged data line is formed about the pixel row while delivering the image or data signal. Moreover, it is formed in a pixel into a row and column direction. And the pixel electrode in which data signal is delivered is formed. And the thin film transistor including the gate electrode connected to a row and column direction to a pixel to the gate line, and the source electrode connected to data line and the drain electrode connected with the pixel electrode is formed.

In the meantime, in the liquid crystal display according to the other feature of the present invention, the red, the blue, and the green pixel are successively arranged to the line writing direction. And the red and green pixel are by turns arranged to the column direction and the blue pixel is identically arranged. The pixel array which is arranged in order to four pixel of the green and the red which is adjacent through the neighboring cephalization deed around the blue pixel of one formed one be in opposite directions is formed. Here, as to the red and green pixel, the rate of the arm length is 2:3. The blue pixel the rate of the arm length is 1:3.

It circumstantially illustrates for the embodiment of the present invention attached in the technical field in which the present invention belongs so that a person skilled in the art easily perform. But the present invention is not restricted to the embodiment which here it illustrates while being implemented as the form which the various disagrees.

In the drawing, in order to specifically express a multi-layer and domain, the thickness was enlarged and it showed. The same diagram symbol was adhered through the specification whole about the similar part. When it has the part of a layer, a film, a domain, a board etc with other part "in the upper part", even in case this has the another part, this includes in not only the case but also the in-between having with other part "in immediately, the upper part". On the contrary, when having with other part "in immediately, the upper part", any kind of part means in an in-between that it does not have the other part.

Now, referring to the figure, concretely, it illustrates for the liquid crystal display according to a preferred embodiment of the present invention.

Figure 1 is a pixel array example of the liquid crystal display for having the pixel array of the penile structure according to the embodiment of the present invention. Figure 2 is a drawing which enlarges the pixel region and indicated of one shown in fig. 1.

As shown in fig. 1, in the liquid crystal display for having the pixel array of the penile structure according to a preferred embodiment of the present invention, the red, arranged to the matrix type the blue, and pixel (-· R, B, G, -·) for the color filter of the green are formed. At this time, the red, the blue, and pixel (-· R, B, G, -·) of the green are successively arranged to the line writing direction. And the red, and the pixel (-· R, G, -·) of the green are by turns arranged as the column direction and blue pixel (B) are identically arranged. It is arranged about neighboring two rows so that the red and green pixel (R, G) be in opposite directions around the blue pixel (B) to the diagonal direction.

In the liquid crystal display for having this pixel array, it can be said to be one pixel region (dot) to be arranged so that four pixel of the green and the red which is adjacent around two blue pixels positioned in the same column be in opposite directions in the neighboring cephalization deed.

In the embodiment of the present invention, each pixel (R, B, G) comprised the pixel region is illustrated in fig. 2 attached, as if the rate of the arm length is made of 2:3. Therefore, as to one pixel region, for the rate of the arm length, 1:1 on the whole. Therefore as shown in Figure 2, it is comprised the shape which is a symmetric of a square.

Referring to figs. 3 and 4, more concretely, the next decides to illustrate for the structure of the thin film transistor substrate of the liquid crystal display according to a preferred embodiment of the present invention for having the pixel arrangement structure.

Figure 3 is a concrete pixel arrangement plan of the thin film transistor substrate of the liquid crystal display according to the embodiment of the present invention having the pixel array. Figure 4 is a cross-sectional view of the thin film transistor substrate for liquid crystal display device which it cuts in fig. 3 according to the III-III' line, it shows.

As shown in fig. 3, in the liquid crystal display for having the pixel array of the penile structure according to a preferred embodiment of the present invention, it is identical with fig. 1. In order to face to the diagonal direction in groups the red, and four pixel (R, G) of the green are arranged around the blue pixel (B) located in the same column of the adjacent pixel row. Each pixel (R, G, B) the rate of the arm length is 2:3.



At this time, as shown in fig. 3, gate line (in other words, the scanning signal line, and 121) delivering the scanning signal or the gate signal to the cross direction are one by one formed with the line writing direction of a pixel about each pixel row. And data line (171) which intersects with the gate line (121) while delivering data signal to a lengthwise and defines the unit pixel is insulated with the gate line (121) and a pixel is formed about the pixel (· R, B, G, ·) heat. Here, in the part in which the gate line (121) and data line (171) intersect, the gate electrode (123), connected to the gate line (121) the source electrode (173), connected to data line (171) the drain electrode (175) formed in the source electrode (173) and opposite side about the gate electrode (123) and the thin film transistor including the semiconductor layer (150) are formed. And the pixel electrode (190) electrically connected through the thin film transistor to the gate line (121) and data line (171) is formed in each pixel.

Moreover, the conductor pattern (177) for the maintenance condenser which is overlapped to the same layer as the gate line (121) with the pixel electrode (190) and forms the storage capacitance is formed. And the conductor pattern (177) for the maintenance condenser is formed on the gate line (121). And it is connected through the contact hole (187) to the pixel electrode (190). In the gate line (121), in order to secure enough storage capacitance, the width of the part in which the conductor pattern (177) for the maintenance condenser is formed is roomily formed than the width of the part in which the conductor pattern (177) for the maintenance condenser is not formed.

Moreover, data line is connected to the drain electrode (175). Moreover, the contact hole (181) of protective film (180, and fig. 3 a , refer to Figure 4) for connecting the pixel electrode (190) and data line is formed on the top of the conductor pattern (177) for the maintenance condenser. And the video signal is delivered from an outside after each data line (171) and data pad (179) for delivering to data line (171) is connected. In this structure, each pixel row is delivered the respective picture signal through data pad connected to data line (171).

More concretely, the gate line is formed on the insulating substrate (100). The gate line provides the gate electrode (123) of the thin film transistor connected to the gate line (121) and the gate pad (125) which it delivers to the gate line it is applied about the gate signal from an outside it is connected to the gate line (121) one by one formed with the line writing direction of a pixel about each pixel row, and the end of the gate line (121).

The gate insulating layer (140) consisting of the silicon nitride (SiNx) \*\*\*.covers the gate line on the substrate (100).

The semiconductor layer (150) consisting of a semiconductor including the amorphous silicon etc. is formed with an island at the upper part of the gate insulating layer (140) of the gate electrode (125). And the ohmic contact layer (160) made as the material of the n+ amorphous silicon hydride \*\*\* in which the silicide or the n-type impurity is doped to the high concentration on the top of the semiconductor layer (150) is formed. On the other hand, the semiconductor layer (150) can be formed according to the shape of data line (171).

The data line is formed on the ohmic contact layer (160) and gate insulating layer (140). The data line provides the drain electrode (175) which is formed in upper part about the gate electrode (123) the opposite side resistant contact layer (160) of the source electrode (173) while being separated from data line (171), which is formed with a lengthwise and intersects with the gate line (121) and defines a pixel the source electrode (173), which is the basin of data line (171) and is extended to the top of the ohmic contact layer (160) data pad (179) which is applied about the picture signal from an outside while being connected after one side of data line (171) and the source electrode (173).

The protective film (180) is formed at the upper part of data line and the semiconductor layer (150) which these does not cover. In the protective film (180), the respective contact holes (185, 189) shown is formed with the drain electrode (175) and data pad (179) as the. And the contact hole (182) showing the gate pad (125) with the gate insulating layer (140) is formed.

The pixel electrode (190) which is positioned in a pixel while being electrically connected on the protective film (180) through the contact hole (181) to the drain electrode (175) is formed. Moreover, the assistance gate pad (95) and the supplementary data pad (97) connected through contact holes (182, 189) to the respective gate pad (125) and data pad (179) are formed on the protective film (180).

Here, it is overlapped with the gate line (121) and as shown in the pixel electrode (190) in figs. 3 and 4, it is comprised the maintenance condenser. And in case the storage capacitance is insufficient, the wiring for holding capacity can be added in the same layer as gate lines (121, 125, 123).

One pixel region the red of 4 and the formed green pixel, which is adjacent to the either side in the liquid crystal display according to a preferred embodiment of the present invention for being made of this structure around two blue pixels (B) located in the same column of the adjacent pixel row and that is, the dot (.

It is marked.

Besides, one dot ( the red positioned in the heat adjacent to one side around two blue pixels (B) located in two pixel rows applying the rendering technique and is adjacent in the same column and green pixel (R, G)

One dot ( the green doing, or is positioned in the heat adjacent to the other side around the blue pixel (B). And red pixel (G, R).

It does and an image can be indicated.

In the meantime, in one pixel region, the blue pixel located in a center can not be formed with two pixels like the embodiment and it can be formed as one pixel.

Figure 5 is a drawing showing each pixel elements size at one pixel region according to another preferred embodiment of the present invention.

As shown in Figure 5, it is formed through two pixel rows in which one blue pixel (B) is adjacent. It can be said to be one pixel region to be arranged so that the red and green pixel (R, G) be in opposite directions around this blue pixel (B) to the diagonal direction in groups.

In this case, the blue pixel the red and green pixel are identical with the embodiment. The rate of the arm length is made of 2:3. But the blue pixel is formed through two pixel rows. Therefore the rate of the arm length is made of the rate of 1:3.

Therefore, as to one pixel region, for the rate of the arm length, 1:1 on the whole. Therefore it forms the shape which is a symmetric of a square.

It easily can design the structure of the thin film transistor substrate of the liquid crystal display according to another preferred embodiment of the present invention for having this pixel array from the pixel array, described the person skilled in the art and structure and the cross section described in the embodiment. Therefore, the detailed description omits.

As to the present invention, a change and the various operation are possible in the range that does not depart from the described claims. For example, the gate line of the liquid crystal display according to the embodiment, data line, the sustain electrode line etc. can be formed with a bilayer.

In the above, concretely it illustrated for the preferred embodiment of the present invention but the scope of right of the present invention belongs to the different deformation and improvement form of the person skilled in the art, using the basic concepts of the present invention which is not thus restricted and defined in the



following claims moreover, the scope of right of the present invention.

**Effect of Invention(Device)**

As described above, according to the present invention, in the pixel array structure of the pentile matrix, as it is formed with the square in which one pixel region is a symmetric, the exact image expression is possible. Therefore, in the pixel array structure of the pentile matrix, it can have the expressive power of the more favorable high definition when indicating the image of figure and letter.

**Scope of Claim(s)**

**Claim [1]**

The rate of the arm length including the thin film transistor including the red with the line writing direction, blue, the pixel array the green pixel is successively arranged, and the red and green pixel are by turns arranged to the column direction and, the gate line, the respective arranged data line about the pixel row the image or data signal is delivered it intersects with the gate line and insulation and it is arranged as a lengthwise, the pixel electrode, and the gate electrode of each pixel is 2:3 persons the liquid crystal display. As to the pixel array the green pixel is successively arranged, and the red and green pixel are by turns arranged to the column direction and, the blue pixel is identically arranged, and which neighboring four pixel of the green and the red is arranged around two blue pixels which are adjacent in the neighboring cephalization deed in order to be in opposite directions. The gate line is arranged as the cross direction about the pixel row, and delivers the scanning signal or the gate signal to a pixel. As to the pixel electrode, it is formed in a pixel into a row and column direction, and data signal is delivered. The gate electrode is connected to the gate line the gate electrode are formed into a row and column direction in a pixel, and the source electrode connected to data line and the drain electrode connected with the pixel electrode.

**Claim [2]**

In the blue pixel, the rate of the arm length 1:3 persons the liquid crystal display the red and the green pixel including the thin film transistor including the red with the line writing direction, blue, the pixel array the green pixel is successively arranged, and the red and green pixel are by turns arranged to the column direction and, the gate line, the respective arranged data line about the pixel row the image or data signal is delivered it intersects with the gate line and insulation and it is arranged as a lengthwise, the pixel electrode, and the gate electrode the rate of the arm length is 2:3. As to the pixel array the green pixel is successively arranged, and the red and green pixel are by turns arranged to the column direction and, the blue pixel is identically arranged, and which neighboring four pixel of the green and the red is arranged through the neighboring cephalization deed around the blue pixel of one formed one in order to be in opposite directions. The gate line is arranged as the cross direction about the pixel row, and delivers the scanning signal or the gate signal to a pixel. As to the pixel electrode, it is formed in a pixel into a row and column direction, and data signal is delivered. The gate electrode is connected to the gate line the gate electrode are formed into a row and column direction in a pixel, and the source electrode connected to data line and the drain electrode connected with the pixel electrode.

**Claim [3]**

The liquid crystal display of claim 1 or 2, wherein the liquid crystal display operates to the rendering driving technique.

**Claim [4]**

The liquid crystal display of claim 1 or 2, wherein the protective film the protective film consisting of the low dielectric constant insulation material is more included it is formed between the pixel electrode, the gate line and data line has the contact hole for electrically connecting the pixel electrode and drain electrode.

**Claim [5]**

In claim 1 or 2.

The data pad for data signal being delivered from an outside in data line is the respective liquid crystal display for being connected.

**Claim [6]**

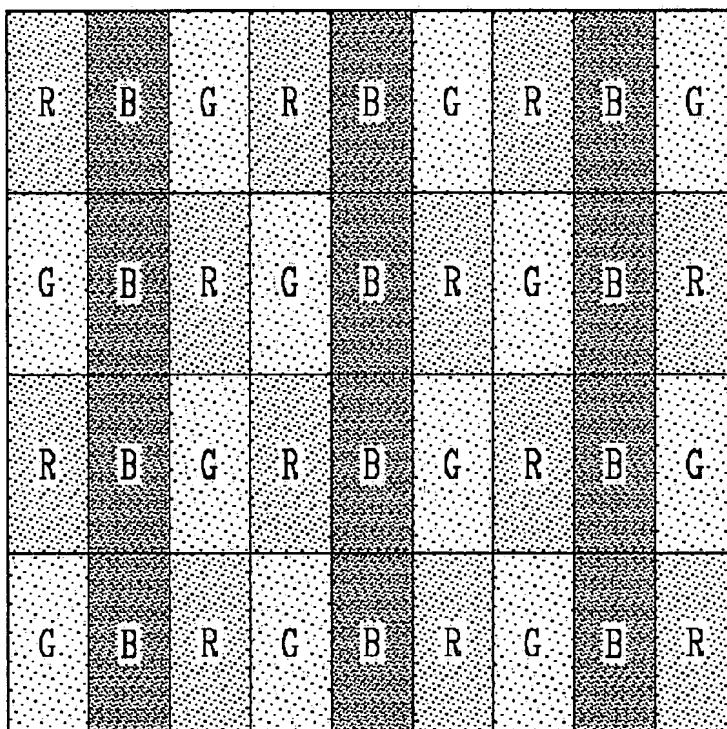
In claim 1 or 2.

The liquid crystal display which the pixel electrode is made of the transparent conducting material or the conducting material having a reflectance.

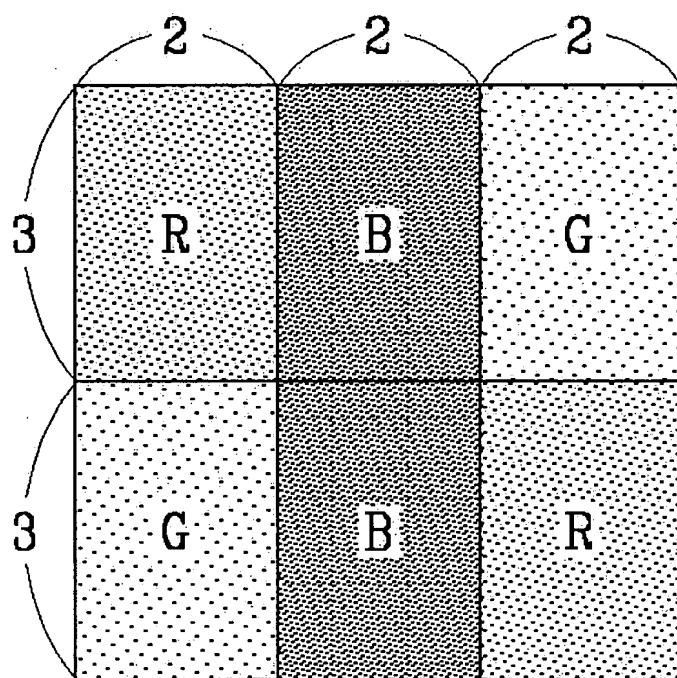
**Drawing**

**Drawing(s)**

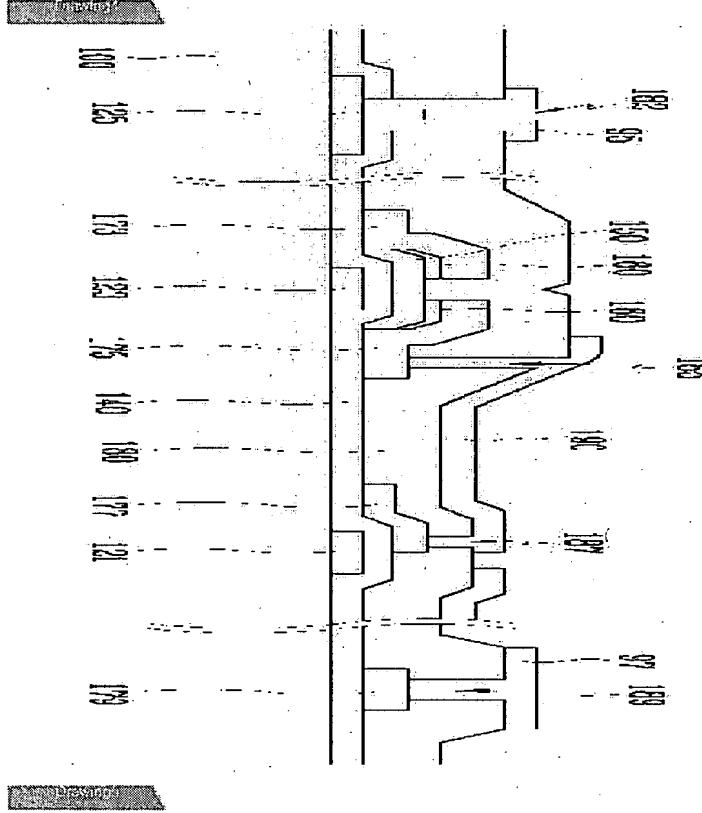
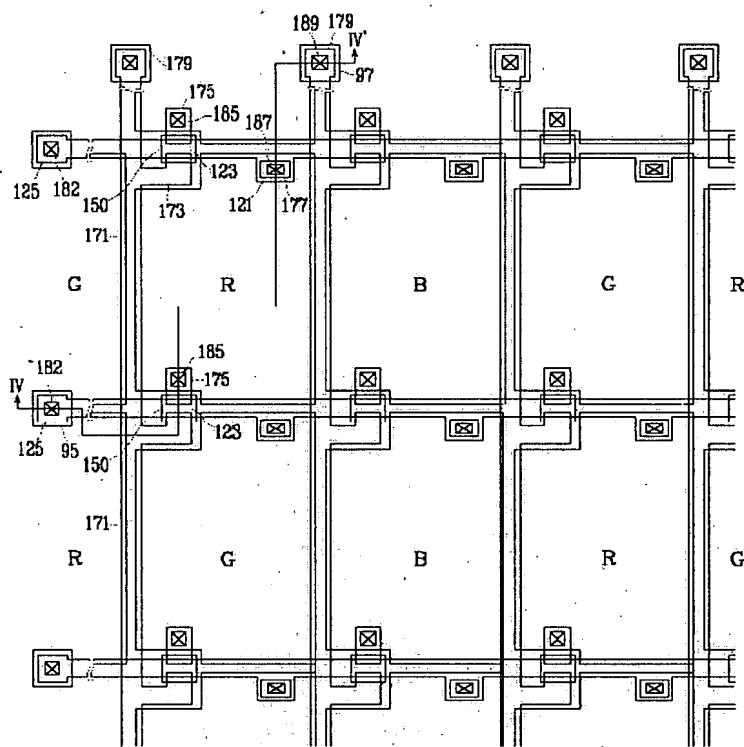
Drawing(s)

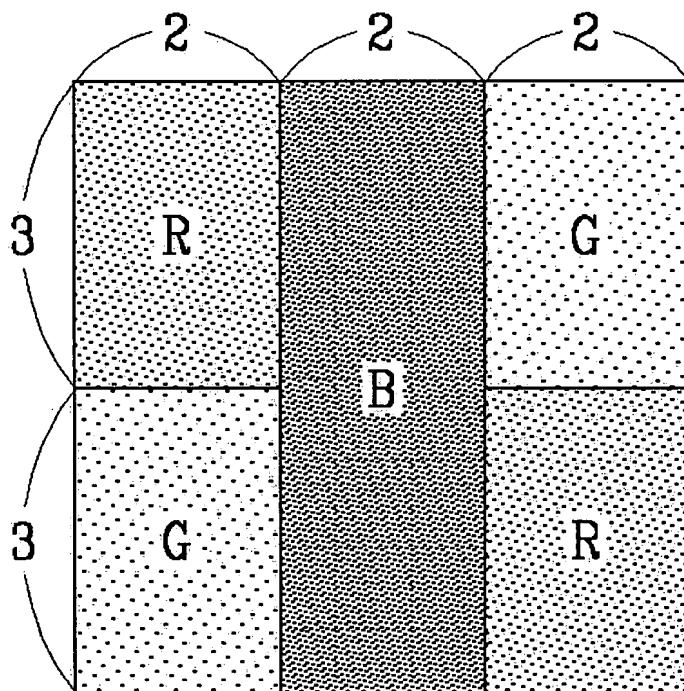


Drawing 2



Drawing 3





gate line (121) with the pixel electrode (190) and forms the storage capacitance is formed. And the conductor (177) for the maintenance condenser is formed on the gate line (121). And it is connected through the contact hole (187) to the pixel electrode (190). In the gate line (121), in order to secure enough storage capacitance, the width of the part in which the conductor pattern (177) for the maintenance condenser is formed is roomily formed than the width of the part in which the conductor pattern (177) for the maintenance condenser is not formed.

- 30 Moreover, data line is connected to the drain electrode (175). Moreover, the contact hole (181) of protective film (180) and Fig. 3 a, refer to Fig. 4) for connecting the pixel electrode (190) and data line is formed on the top of the conductor pattern (177) for the maintenance condenser. And the video signal is delivered from an outside after the data line (171) and data pad (179) for delivering to data line (171) is connected. In this structure, each pixel receives the respective picture signal through data pad connected to data line (171).
- 31 More concretely, the gate line is formed on the insulating substrate (100). The gate line provides the gate electrode (123) of the thin film transistor connected to the gate line (121) and the gate pad (125) which it delivers to the pixel. And the gate signal is applied about the gate signal from an outside it is connected to the gate line (121) one by one formed with the writing direction of a pixel about each pixel row, and the end of the gate line (121).
- 32 The gate insulating layer (140) consisting of the silicon nitride ( $SiN_x$ ) \*\*\* covers the gate line on the substrate (100).
- 33 The semiconductor layer (150) consisting of a semiconductor including the amorphous silicon etc. is formed on the gate insulating layer (140) of the gate electrode (125). And the ohmic contact layer is formed as the material of the n+ amorphous silicon hydride \*\*\* in which the silicide or the n-type impurity is doped with high concentration on the top of the semiconductor layer (150) is formed. On the other hand, the semiconductor layer (150) can be formed according to the shape of data line (171).
- 34 The data line is formed on the ohmic contact layer (160) and gate insulating layer (140). The data line provides the drain electrode (175) which is formed in upper part about the gate electrode (123) the opposite side resistive layer (160) of the source electrode (173) while being separated from data line (171), which is formed with a line and intersects with the gate line (121) and defines a pixel the source electrode (173), which is the basin of data line (171) and is extended to the top of the ohmic contact layer (160) data pad (179) which is applied about the pixel signal from an outside while being connected after one side of data line (171), and the source electrode (173).
- 35 The protective film (180) is formed at the upper part of data line and the semiconductor layer (150) which these do not cover. In the protective film (180), the respective contact holes (185, 189) shown is formed with the drain electrode (175) and data pad (179) as the. And the contact hole (182) showing the gate pad (125) with the gate insulating layer (140) is formed.
- 36 The pixel electrode (190) which is positioned in a pixel while being electrically connected on the protective film (180) through the contact hole (181) to the drain electrode (175) is formed. Moreover, the assistance gate pad (95), supplementary data pad (97) connected through contact holes (182, 189) to the respective gate pad (125) and data pad (179) are formed on the protective film (180).
- 37 Here, it is overlapped with the gate line (121) and as shown in the pixel electrode (190) is figs. 3 and figs. 3 it comprised the maintenance condenser. And in case the storage capacitance is insufficient, the wiring for hole capacity can be added in the same layer as gate lines (121, 125, 123).
- 38 In the liquid crystal display according to a preferred embodiment of the present invention for being made of the

structure, it is the red and the formed green pixel which is adjacent to the either side around two blue pixels (R, B, G, B, C) in the same column of the adjacent pixel row and of 4 indicated as one pixel region, that is, the dot (G, B, F)

39 Besides, it has the red and the green pixel (R, G) positioned in the heat adjacent to one side as one dot (G, B, C) around two blue pixels (B) located in two pixel rows applying the rendering technique and is adjacent in the same column, or it has the green and the red pixel (G, R) positioned in the heat adjacent to the other side as one dot (B, G, B, R) around the blue pixel (B) and an image can be indicated.

40 In the meantime, in one pixel region, the blue pixel located in a center can not be formed with two pixels like the embodiment and it can be formed as one pixel.

41 Fig. 5 is a drawing showing each pixel elements size at one pixel region according to another preferred embodiment of the present invention.

42 As shown in Fig. 5, it is formed through two pixel rows in which one blue pixel (B) is adjacent. It can be said to the pixel region to be arranged so that the red and green pixel (R, G) be in opposite directions around this blue pixel in the diagonal direction in groups.

43 In this case, the blue pixel the red and green pixel are identical with the embodiment. The rate of the arm length is made of 2:3. But the blue pixel is formed through two pixel rows. Therefore the rate of the arm length is made at the rate of 1:3.

44 Therefore, as to one pixel region, for the rate of the arm length, 1:1 on the whole. Therefore it forms the shape of a symmetric of a square.

45 It easily can design the structure of the thin film transistor substrate of the liquid crystal display according to a preferred embodiment of the present invention for having this pixel array from the pixel array, described the person skilled in the art and structure and the cross section described in the embodiment. Therefore, the detailed description omits.

46 As to the present invention, a change and the various operation are possible in the range that does not do no from the described claims. For example, the gate line of the liquid crystal display according to the embodiment, the data line, the sustain electrode line etc. can be formed with a bilayer.

47 In the above, concretely it illustrated for the preferred embodiment of the present invention but the scope of the present invention belongs to the different deformation and improvement form of the person skilled in the art, the basic concepts of the present invention which is not thus restricted and defined in the following claims moreover the scope of right of the present invention.

#### › Effects of the Invention

48 As described above, according to the present invention, in the pixel array structure of the pentile matrix, as it is with the square in which one pixel region is a symmetric, the exact image expression is possible. Therefore, in the pixel array structure of the pentile matrix, it can have the expressive power of the more favorable high definition indicating the image of figure and letter.

## Scope of Claims

### Claim[1] :

49 The rate of the arm length including the thin film transistor including the red with the line writing direction, blue pixel array, the gate line, the respective arranged data line about the pixel row the image or data signal is delivered intersects with the gate line and insulation and it is arranged as a lengthwise, the pixel electrode, and the gate electrode of each pixel is 2:3 persons the liquid crystal display, and the pixel array the green pixel is successively arranged; the red and green pixel are by turns arranged to the column direction and the blue pixel is identically arranged; and neighboring four pixel of the green and the red is arranged around two blue pixels which are at the neighboring cephalization deed in order to be in opposite directions; the gate line is arranged as the cross about the pixel row; and delivers the scanning signal or the gate signal to a pixel; as to the pixel electrode, it is formed in a pixel into a row and column direction; and data signal is delivered; and the gate electrode is connected to the line the gate electrode are formed into a row and column direction in a pixel, and the source electrode connected to data line and the drain electrode connected with the pixel electrode.

### Claim[2] :

56 In the blue pixel, the rate of the arm length 1:3 persons the liquid crystal display the red and the green pixel is the thin film transistor including the red with the line writing direction, blue, the pixel array, the gate line, the respective arranged data line about the pixel row the image or data signal is delivered it intersects with the gate line and insulation and it is arranged as a lengthwise, the pixel electrode, and the gate electrode the rate of the arm length is 2:3, and the pixel array the green pixel is successively arranged; the red and green pixel are by turns arranged to the column direction and the blue pixel is identically arranged; and neighboring four pixel of the green and the red is arranged through the neighboring cephalization deed around the blue pixel of one formed one in order to be in opposite directions; the gate line is arranged as the cross direction about the pixel row; and delivers the scanning signal or the gate signal to a pixel; as to the pixel electrode, it is formed in a pixel into a row and column direction; and data signal is delivered; and the gate electrode is connected to the gate line the gate electrode are formed into a row and column direction in a pixel, and the source electrode connected to data line and the drain electrode connected with the pixel electrode.

### Claim[3] :

63 The liquid crystal display of claim 1 or 2, wherein the liquid crystal display operates to the rendering driving to

### Claim[4] :

65 The liquid crystal display of claim 1 or 2, wherein the protective film the protective film consisting of the low dielectric constant insulation material is more included it is formed between the pixel electrode, the gate line and data line the contact hole for electrically connecting the pixel electrode and drain electrode.

### Claim[5] :

68 In claim 1 or 2.

69 The data pad for data signal being delivered from an outside in data line is the respective liquid crystal display being connected.

### Claim[6] :

70 In claim 1 or 2.

71 The liquid crystal display which the pixel electrode is made of the transparent conducting material or the cond

material having a reflectance.

**The Korean Intellectual Property Office (KR)  
Publication of Application (A)**

**(51) Int.Cl.**  
**G02F 1/133**

**(11) Publication No** 10-2003-0086157

**(43) Publication Date** 2003-11-07

**(21) Application No** 10-2002-0024539

**(22) Application Date** 2002-05-03

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**Examination Requested** : EopEum

**(54) LIQUID CRYSTAL DEVICE**

 **Abstract**

**Machine Translation**

**Human Translation**

**PURPOSE:** A liquid crystal display device is provided to form each pixel area in the symmetrical square shape for precise image display, thereby realizing the high resolution in the display of characters or figures.

**CONSTITUTION:** A liquid crystal display device includes pixels arranged in the PenTile matrix structure. In the line direction, red, blue and green pixels(R,B,G) are arranged in sequence. In the column direction, the red and green pixels are arranged alternately and the blue pixels are arranged in the same column. In neighboring two lines, the red and green pixels respectively face each other via the blue pixels in the diagonal direction. The rate of traverse and longitudinal pixels is 1:1 in a symmetric square shape.

 **Representative Drawing(s)**

Fig. 2

 **Keyword(s)**

The phental structure, a pixel, and LCD.

 **Description**

› **Brief explanation of the drawing**

- 2 Fig. 1 is an arrangement plan showing the pixel array structure of the liquid crystal display for having the pixel array structure according to a preferred embodiment of the present invention.
- 3 Fig. 2 is a drawing showing each pixel elements size at the pixel region of one illustrated in Fig. 1.
- 4 Fig. 3 is a drawing showing the pixel structure of the thin film transistor of the liquid crystal display according to a preferred embodiment of the present invention.
- 5 Fig. 4 is a cross-sectional view of the thin film transistor substrate for liquid crystal display device which it cuts according to the IV-IV' line, it shows.
- 6 Fig. 5 is a drawing showing each pixel elements size at one pixel region according to another preferred embodiment of the present invention.

▶ Details of the Invention

▶ Purpose of the Invention

The Technical Field to which the Invention Belongs and the Prior Art in that Field

- 7 The present invention relates to the liquid crystal display, more particularly, to an apparatus and method for the liquid crystal display, for having the pentile pixel array structure for indicating the image of the high definition. This.
- 8 As to the liquid crystal display, by injecting the liquid crystal material between the two-board having the electrodes producing the electric field and authorizing the different electric potential in two electrodes it forms the electric field. Generally it changes the arrangement of the liquid crystal molecules. It is the apparatus for expressing an image through this, by controlling the transmittance ratio of the light.
- 9 This liquid crystal display has a plurality of pixels in which the pixel electrode and red, the green, and the color filter of the blue are formed. And each pixels run with the signal applied through the wiring and the indication action is performed. In the wiring, it has the image signal line or data line delivering the scanning signal line or the gate line delivering the scanning signal, and the picture signal. And the picture signal which is delivered to the pixel electrode through the pixel electrode is formed in a pixel while as to each pixel, the thin film transistor connected to one gate line and one data line is controlled.
- 10 At this time, there can be the mosaic type, who successively arranges the red (R), the green (G), and the color filter of the blue (B) to the stripe type arranging the pixel row the color filter of the colour binding to the unit, and the horizontal line writing direction the delta type etc. arranges and successively arranges the red (R), the green (G), and the color filter of the blue (B) to the zig-zag type in order to be unit pixels crossed in the column direction as the array in the red (R), the green (G), and the color filters of the blue (B) are variously arranged in each pixel. In case of like, when indicating an image three unit pixels including the red (R), the green (G), and the color filter of the blue (B) by one dot, a circular or a diagonal is expressed in the display and it has the favorable expressive power.
- 11 Moreover, in "ClairVoyante Laboratories", the pixel array structure called "The PenTile Matrix™ color pixel arrangement" which had the expressive power of the more favorable high definition when indicating an image could minimize the design cost at the same time was suggested. In the pixel array structure of this pentile matrix, the unit pixel of the blue is together shared when indicating two dots. And data signal is delivered by one data driver integrated circuit and the unit pixel of the neighboring blue runs with the different gate drive integrated circuit.

number of cheap gate drive integrated circuit this pentile matrix pixel structure is useds can reduce the number overhead data drive integrated circuit it increaseses and it can minimize the design cost of the display device.

12. But generally, the arm vertical ratio of one pixel is 1:3. The liquid crystal display for having the pixel array of the matrix indicates the blue pixel, formed through two rows the red and the green pixel which is arranged in order around this by one dot. Therefore one dot is shaped of the asymmetrical rectangular.
13. Therefore, one dot does not fit for the VESA (Video Electronics Standards Association) standard. And the pro the exact image expression is not facilitated is generated according to that.

#### Technical challenges of the Invention:

14. Therefore, the technical problem of the present invention provides the liquid crystal display for doing the exact same time image display in which the display ability is excellent

#### ‣ Structure & Operation of the Invention

15. In the liquid crystal display according to the characteristic of the present invention for achieving this technical the red, the blue, and the green pixel are successively arranged to the line writing direction. And the red and green pixel are by turns arranged to the column direction and the blue pixel is identically arranged. The pixel array which is arranged in order to four pixel of the green and the red which is adjacent around two blue pixels which are adjacent the neighboring cephalization deed be in opposite directions is formed. Here, it is made of the red, and in each the green and blue, the rate of the arm length 2:3.
16. Here, it is arranged as the cross direction about the pixel row. And the gate line delivering the scanning signal gate signal is formed in a pixel. And it intersects with the gate line and insulation and the gate line is arranged lengthwise. And the respective arranged data line is formed about the pixel row while delivering the image or signal. Moreover, it is formed in a pixel into a row and column direction. And the pixel electrode in which data delivered is formed. And the thin film transistor including the gate electrode connected to a row and column direction a pixel to the gate line, and the source electrode connected to data line and the drain electrode connected with the pixel electrode is formed.
17. In the meantime, in the liquid crystal display according to the other feature of the present invention, the red, the blue, and the green pixel are successively arranged to the line writing direction. And the red and green pixel are by turns arranged to the column direction and the blue pixel is identically arranged. The pixel array which is arranged in order to four pixel of the green and the red which is adjacent through the neighboring cephalization deed around the blue of one formed one be in opposite directions is formed. Here, as to the red and green pixel, the rate of the arm length is 2:3. The blue pixel the rate of the arm length is 1:3.
18. It circumstantially illustrates for the embodiment of the present invention attached in the technical field in which the present invention belongs so that a person skilled in the art easily perform. But the present invention is not restricted to the embodiment which here it illustrates while being implemented as the form which the various disagrees.
19. In the drawing, in order to specifically express a multi-layer and domain, the thickness was enlarged and it shows. The same diagram symbol was adhered through the specification whole about the similar part. When it has the upper part a layer, a film, a domain, a board etc with other part "in the upper part", even in case this has the another part includes in not only the case but also the in-between having with other part "in immediately, the upper part". On the contrary, when having with other part "in immediately, the upper part", any kind of part means in an in-between does not have the other part.

20 Now, referring to the figure, concretely, it illustrates for the liquid crystal display according to a preferred embodiment of the present invention.

21 Fig. 1 is a pixel array example of the liquid crystal display for having the pixel array of the pentile structure according to the embodiment of the present invention. Fig. 2 is a drawing which enlarges the pixel region and indicated of shown in Fig. 1.

22 As shown in Fig. 1, in the liquid crystal display for having the pixel array of the pentile structure according to a preferred embodiment of the present invention, the red, arranged to the matrix type the blue, and pixel (.. R, E for the color filter of the green are formed. At this time, the red, the blue, and pixel (.. R, B, G, ..) of the green are successively arranged to the line writing direction. And the red, and the pixel (.. R, G, ..) of the green are by the arranged as the column direction and blue pixel (B) are identically arranged. It is arranged about neighboring so that the red and green pixel (R, G) be in opposite directions around the blue pixel (B) to the diagonal direction.

23 In the liquid crystal display for having this pixel array, it can be said to be one pixel region (dot) to be arranged four pixel of the green and the red which is adjacent around two blue pixels positioned in the same column be in opposite directions in the neighboring cephalization deed.

24 In the embodiment of the present invention, each pixel (R, B, G) comprised the pixel region is illustrated in Fig. 2 attached, as if the rate of the arm length is made of 2:3. Therefore, as to one pixel region, for the rate of the arm length, 1:1 on the whole. Therefore as shown in Fig. 2, it is comprised the shape which is a symmetric of a square.

25 Referring to figs. 3 and figs. 3 more concretely, the next decides to illustrate for the structure of the thin film transistor substrate of the liquid crystal display according to a preferred embodiment of the present invention for having arrangement structure.

26 Fig. 3 is a concrete pixel arrangement plan of the thin film transistor substrate of the liquid crystal display according to the embodiment of the present invention having the pixel array. Fig. 4 is a cross-sectional view of the thin film transistor substrate for liquid crystal display device which it cuts in Fig. 3 according to the III-III' line, it shows.

27 As shown in Fig. 3, in the liquid crystal display for having the pixel array of the pentile structure according to a preferred embodiment of the present invention, it is identical with Fig. 1. In order to face to the diagonal direction groups the red, and four pixel (R, G) of the green are arranged around the blue pixel (B) located in the same of the adjacent pixel row. Each pixel (R, G, B) the rate of the arm length is 2:3.

28 At this time, as shown in Fig. 3, gate line (in other words, the scanning signal line, and 121) delivering the scan signal or the gate signal to the cross direction are one by one formed with the line writing direction of a pixel in each pixel row. And data line (171) which intersects with the gate line (121) while delivering data signal to a pixel and defines the unit pixel is insulated with the gate line (121) and a pixel is formed about the pixel (.. R, B, G, ..). Here, in the part in which the gate line (121) and data line (171) intersect, the gate electrode (123), connected to the gate line (121) the source electrode (173), connected to data line (171) the drain electrode (175) formed in the electrode (173) and opposite side about the gate electrode (123) and the thin film transistor including the semiconductor layer (150) are formed. And the pixel electrode (190) electrically connected through the thin film transistor to the gate line (121) and data line (171) is formed in each pixel.

29 Moreover, the conductor pattern (177) for the maintenance condenser which is overlapped to the same layer